sufficiently beaten up together in the manner of common mortar. The hay should be put in after the two other ingredients are well mixed up together with water. This plaster should be made stiff; and when the flooring boards are required to be laid down very soon, a fourth or fifth part of quicklime in powder, formed by dropping a small quantity of water on the limestone shortly before it is used, and well mixed with this rough plaster, will cause it to dry quickly. If any cracks appear in the rough plaster work near the joists, when it is thoroughly dry, they ought to be closed by washing them over with a brush wet with mortar wash; this wash may be prepared by putting two measures of quicklime and one of common sand into a vessel, and stirring the mixture with water till the water becomes of the consistence of a thin jelly.

Before the flooring boards are laid, a small quantity of very dry common sand should be strewed over the plaster work, and struck smooth with a hollow rule moved in the direction of the joists, so that it may lie rounding between each pair of joists. The plaster work and sand should be perfectly dry before the boards are laid, for fear of the dry rot. The method of under-flooring may be applied to a wooden staircase, but no sand is to be laid upon the rough plaster work. The method of extra-lathing may be applied to ceiling joists, to sloping roofs, and to wooden partitions. The third method, which is that of inter-securing, is very similar to that of under-flooring; but no sand is afterwards to be laid on. Inter-securing is applicable to the same parts of a building as the method of extra-lathing.

Such is a general outline of the modes proposed by Lord Mahon for rendering houses fire-proof; in which it will be seen that the safeguard consists in the use of a non-combustible material with, and among, and between the pieces of wood forming the frame-work of a house.

The more recent attempts to gain the same object by means somewhat similar have been very numerous; some of which we may here notice as examples of the whole.

An American patent was granted in 1837 to a Mr. Louis Pambouf, for the invention of a fire-proof paint. The mode of preparing it is thus described. A quantity of the best quicklime is selected, and slacked with water in a covered vessel; when the slacking is complete, water, or skimmed milk, or a mixture of both, is added to the lime, and mixed up with it to the consistence of cream. When milk is not used, a solution of rice paste is employed, obtained by boiling eight pounds of rice to every hundred gallons of paint. When the creamy liquor is prepared, alum, potash, and common salt are added, in the proportion of twenty pounds of alum, fifteen pounds of potash, and a bushel of salt, to every hundred gallons of the paint. If the paint is to be white, six pounds of prepared plaster of Paris and the same quantity of fine white clay are added to the above proportions of the other ingredients. All these ingredients being mingled, the mixture is strained through a fine sieve, and then ground in a colour-mill.

When roofs are to be covered, or when crumbling brick walls are to be coated, fine white sand is mixed with the paint, in the proportion of one pound to ten gallons of paint; this addition being made with a view to giving the ingredients a binding or petrifying quality. In applying this paint, except in very warm weather, it is prepared in a hot state; and in very cold weather precautions are necessary to prevent it from freezing. Three coats of this paint are deemed in most cases sufficient.

In another variety of this paint oil is the chief liquid ingredient. To prepare it forty gallons of boiled linseed oil are mixed with slacked lime to the consistence of a paint; and to this are added two pounds of alum, one pound of potash, and eight pounds of common salt; or good wood-ashes may be substituted for the potash. This paint is used in the same manner as other paint; and any colour may be obtained by adding the usual pigments to the composition.

The preparation of a kind of paint containing alkalies seems to have been a favourite measure among inventors of "fire-proof" composition; for many of the modern projects have had this for its basis. But in most cases there have not been means for determining the degree of efficacy possessed by these compositions.

Perhaps the mode in which we may more consistently look for the practical attainment of the object in view is by the adoption of some improved mode of building, in which either wood is not employed at all, or, where sparingly used, measures are taken to shield it from the action of fire. One such method is Lecomte's, described as follows.

This plan consists in the employment of iron frames to receive concrete matter for forming the walls. The basement story of the building is constructed according to the ordinary methods up to one foot or more above the ground. On the basement so constructed is to be erected the patent wall, formed of frames entirely of cast-iron, in one or more pieces, or a combination of cast-iron and wrought-iron plates. These frames are to be set one on the other until the required height is attained, the necessary stability being obtained by means of steady pins at the corners of one frame fitting into holes made in the corners of the frame which is opposed to it. Suitably-shaped frames are employed for the internal partition walls, and for doorways, window-frames, &c. The flues of the chimneys are formed of iron or other metal pipes, placed in the thickness of the walls. When the required elevation is obtained; a concrete of any suitable material is poured into the framing, and fills up the vacant space, giving firmness and solidity to the structure; the concrete being made of gravel and lime. To give steadiness, lead is to be introduced between the joinings of the iron-work. The doors and window-frames are to be fastened to the walls by any of the usual known methods. The main beams and cross beams of floors and roofs may be of cast-iron, or formed of iron and wood; or they may be formed of one or more pieces of plate-iron, bent up into an oval form, and straightened by an iron or wooden bar passing through them lengthwise, the upper edges of the metal being turned over to increase the strength. In the interval between the beams there are to be iron rods running in various directions, and supporting a metallic wire-work, which forms the foundation for the ceiling. Similar wire-work is to be employed in lieu of lathes for all plaster surfaces. All the iron-work is be painted over with some suitable composition to prevent oxidation.

A plan for the same purpose has been proposed by Mr. Varden as follows:—"It appears probable that common fir or oak joists with their lower edges chamfered, and coated over with a mixture of alum, black lead, clay, and lime, or some similar composition, would (if closely floored above with earthenware tiles, bedded all round into the plastering, the joists being made air-tight) resist the action of flames, at least for a considerable time. Fire could not descend through such a flooring so as to communicate with the rooms below, till the tiles used in it had become red-hot; neither could it ascend until the tiled floor above gave away from the burning joists; which if coated, as proposed, would not take fire from below till the tiling over them acquired a sufficient heat to cause the distillation of the turpentine from the wood. In general, there is not furniture enough of a combustible nature in any room to do this. The battening against the outer walls might be of larch, as that wood burns less freely than most others; but if the walls were brick, or lined with brick, battening of any kind will be unnecessary. If this plan should be thought likely to answer the end proposed, houses built in the common manner might be altered at a moderate expense, by taking up the boarded floors, and substituting earthenware tiles."

Another plan, proposed by Mr. Frost, consists in forming the floors of rooms of hollow earthenware tubes embedded in cement, combined so as to form a sort of flag-stone, covering the whole floor. These hollow tubes are squares in section, about an inch and a half on the side externally, with a tubular space of an inch and quarter on the side internally; they are formed of brick earth, prepared in a superior manner, and pressed through moulds by machinery; and their length is about two feet. In forming a floor of these tubes, the centering, after being prepared and fixed in the usual manner, is first covered with a coating of cement of a quality sufficiently fine to form the ceiling of the apartment to be floored over; and if it is desired that there should be mouldings or ornaments in this ceiling or its cornices, moulds for them can be placed in the centering, so as to form a part of it. One or two coats of cement having then been laid over the centering, a stratum of the square tubes laid side by side, and breaking joint, is next embedded in fine cement, and the interstices between them also filled in with that material. One thin coating of cement is then laid over the whole stratum; and in a week, when this is dry, another stratum of tubes is laid over the first in a contrary direction, bedded and filled in with cement as before, and finished by a coating of the same material.

Mr. Loudon gives descriptions of two methods, the one for building houses in general fire-proof, and the other for imparting that property to houses already built. He considers the two main points for the consideration to be, to have staircases of iron or stone, or both combined, and to avoid having any hollow partitions or floors. A house having a stone or iron staircase, and having all the partitions either of four-inch brickwork, or of brick nogging, in whatever way it might be set on fire, could hardly be burned down, if ordinary exertions were made to extinguish the flames. One apartment might be set on fire, but before the flames could spread to the one under or over it, or to a staircase adjoining it, the fire might be extinguished. In a house so constructed there would be no piece of timber that was not in close contact with mortar, at least on one side; and all the strong pieces of timber, such as joists, rafters, quartering in partitions, &c., would be closely imbedded in mortar on two sides. Where the partition could not be made entirely of brick, the interstices might be filled up with a mortar prepared of clay with a small proportion of lime. The same material might be filled in between the joists, and where it was desired to render the roof fire-proof, the rafters might be made of iron, or the space between wooden rafters might be filled in with thin mortar. This mode of proceeding would lengthen the time required for the drying of a newly-built house, and would also add somewhat to the expense; but it is conceived that the increased safety would more than counterbalance these inconveniences.

In respect to the means of giving a fire-proof quality to a house already built, Mr. Loudon remarks:—"All the interstices between the floors, in the partitions, and in the roof, where there was a ceiling formed to the rafters, might perhaps be filled in with earthy matter in a state of powder. This powder might be clay or loam mixed with a small proportion of Roman cement; it might be injected into the vacuities, through small orifices, by some description of forcing-pump or bellows, which, while it forced in the powder, would permit the escape of the air; and, while this operation was going forward steam might be injected at the same time so as to mix with the mortar and be condensed by it; by which means the whole mass would be solidified with a minimum of moisture. In short, in rendering houses fire-proof, the next important object to using fire-proof materials, is that of having all the walls and partitions, and even the steps of wooden staircases, filled in with such materials as will render them in effect solid. On examining into the causes of the rapidity of the spread of the flames in London houses when on fire, it would almost invariably be found, that whatever may have occasioned the fire to break out, the rapidity of its progress has been in proportion to the greater or less extent of the lath and plaster partitions, the hollow wooden floors, and the wooden staircases. Were the occupiers of houses sufficiently aware of the danger from lath and plaster partitions, especially when inclosing staircases, they would never occupy such houses, or, if they did, they would not give such rents for them as they would for houses with brick-nogging partitions. It appears to us to be the duty either of the general or local government or police to see that no houses are built without stone or iron staircases; and that no partitions and floors are made hollow; or, if they are, that the materials should be iron and tiles, or slates, or stones, or cement, or other earthy composition."—*The Useful Arts Employed in the Construction of Dwelling Houses.*

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